2.0 Introduction

2.1 Purpose of the Document

The purpose of this document is to provide for the extensive review of the NILS Concept of Operations and User Requirements by the NILS partners and others involved with cadastral land records. Meetings are being held in Portland, OR, Phoenix, AZ, Denver, CO, Atlanta, GA and Washington, D.C. to facilitate the review. The document will also be available on the BLM's web page at **www.blm.gov/nils** and the comment period will be from November 29, 1999 until January 15, 2000.

NILS is an initiative to provide a business process method to collect, maintain, and store parcel-based information that meets the needs of the widest possible spectrum of land title and resource information providers and customers. NILS is being managed in a partnership environment. The primary partners are BLM, the U.S. Forest Service, states and counties and private industry. A list of participants is included in Appendix B. In addition, NILS has an advisory group, called the Parcel Consortium, which includes BLM, U.S. Forest Service, ESRI, Inc., Oakland County, MI and Fairview Industries.

2.2 Background

2.2.1 Department of the Interior, Bureau of Land Management

The mission of the Bureau of Land Management (BLM) is "to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations." BLM, which is part of the Department of the Interior, manages about 264 million acres of public lands. BLM also manages another 300 million acres of subsurface mineral resources that underlie lands administered by other government agencies or are owned by private interests. These lands are located in 28 states, primarily in the West and Alaska.

The BLM maintains land and mineral records for the Nation's public and Indian lands, including over one billion documents such as land surveys, surveyor notes, tract books, Master Title Plats (MTP), Historical Indices land patents, mining claims, oil and gas leases, and land and mineral case files. Many of these paper documents are deteriorating and some are becoming illegible. Most of the original records and plats are manually maintained and stored in a number of locations throughout the western United States and several locations in the East. Some of the information contained in these documents has been entered into various databases beginning in the 1970s.

When the energy boom began in the early 1980s, BLM found it could not handle the paper workload demand and recognized the need to become more efficient and cost effective by automating many of its public land tenure records. BLM began an effort to automate its land and mineral records. This proposed system was called the Automated Land and Mineral Record System (ALMRS) but this system was never completed.

2.2.2 Department of Agriculture, U.S. Forest Service

The U.S. Forest Service, Department of Agriculture, manages approximately 191 million surface acres of land scattered throughout the United States. In 1958, the Forest Service began a modernization effort to update its land status records that resulted in the establishment of the standard Land Status Atlas, containing status maps and a summary of tabular records of title, partial interests, rights and use restrictions pertaining to Forest Service lands. In the 1990s the Forest Service began it's current effort to modernize the Forest Service land records with a project called the Automated Land Project (ALP), which is being implemented throughout the agency.

2.2.3 States, Local Governments, and Private Land Owners

Land records management is also a critical business process for states, counties, townships and cities in the U.S. These are the agencies that interact with private land owners to do the following:

- Manage natural resources (state departments of natural resource management, large private land owners)
- Process land use and development permits (state departments of environmental protection, local governments)
- Record deeds and subdivisions (county recorders, registers)
- Maintain cadastral maps (county assessors)
- Manage infrastructure and rights-of-way (state and local government departments of public works, surveying, engineering, etc.)

All these agencies require powerful tools to access and manage land records and cadastral data as an integral part of daily business operations.

2.2.4 Common Tools and Data Models for Shared Management of the Landscape

Over the last two decades, land managing agencies at all levels of government have found it increasingly difficult to share information, maintain current records and to provide accurate and timely land tenure information to public customers or to support the decision-making process. Population growth, public scrutiny, complex title and use transactions, legal challenges, deteriorating, difficult to access records in a climate of decreased financial support have forced all agencies to consider alternative, more effective technologies.

2.3 The NILS Vision

The NILS vision is to provide a business process method to collect, maintain, and store parcel-based land information that meets the common, shared business needs of the widest possible spectrum of land title and resource information providers and customers. The goals of NILS include the following:

- Provide a comprehensive, integrated, common data model and framework for the management of cadastral land tenure records

- Improve access to land title record information, including ownership, uses and boundaries
- Provide graphic display for land management information
- Facilitate land information data sharing and cooperative collection efforts
- Improve response time to land information queries
- Support the ability to provide a common digital portrayal of land and resource parcels across all jurisdictions
- Provide for the ability to efficiently update information with new or better sources of information
- Provide framework for decision support for collaborative ecosystem management
- Facilitate data sharing, cooperative collection, joint and multi-use land management and distribution of data
- Provide the ability to link parcel-based information with other resource information using geographic information system (GIS) technology to facilitate analysis (Figure 2.1)
- Improve the quality of the information needed to manage and display land, including control, coordinates, land descriptions and parcels
- Integrate positional and descriptive land information for both surveyed and unsurveyed boundaries
- Provide the ability to link alphanumeric (attribute) data with a graphic representations of where the activity occurs (Figure 2.2)

Figure 2.1. Linking Parcel-Based Ownership, Restriction, Rights, Uses, Administration, Case, and Customer Information Using GIS to Facilitate Analysis

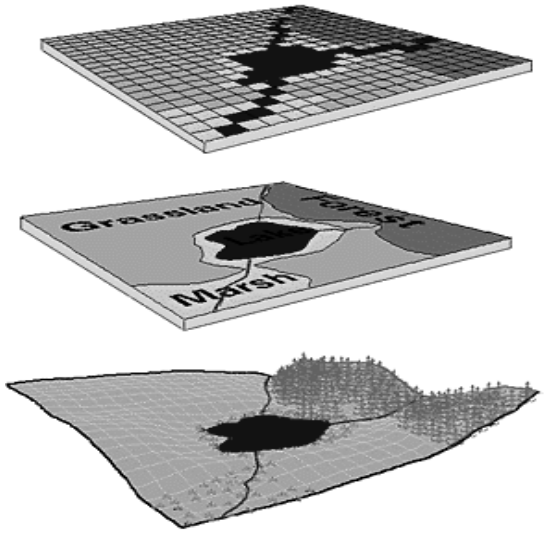
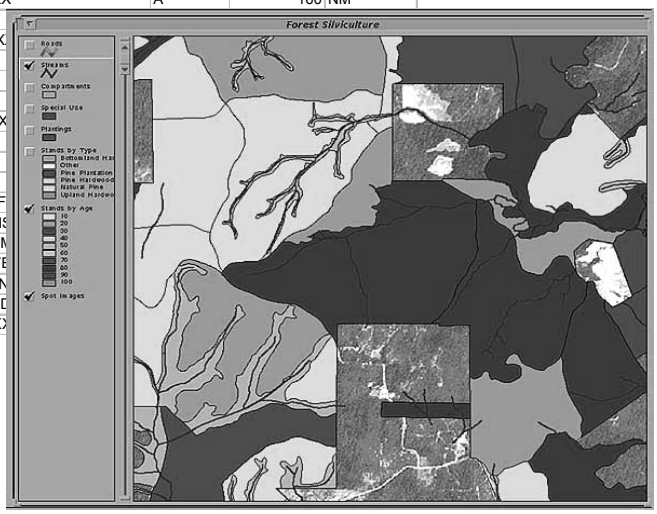


Figure 2.2. Linking Attribute Data and Geographic Data

Land Management agencies and organizations need the ability to link alphanumeric (attribute) data and (geo)graphic representations. This is an example of BLM's attribute data from the LR 2000/Case Recordation System

Land Id	System Id	Blm Admin State	Meridian	Township	Range	Section	Aliq Part	Sur Type	St Acreage	Geo State
8603	CR	NM	23	0230N	0130W	21	NE;	A		NM
8605	CR	NM	23	0290N	0100E	1	S2NE,SE;	A		NM
8614	CR	NM	23	0290N	0100E	10	N2N2,S2SE;	A		NM
8617	CR	NM	23	0290N	0100E	13	N2,NESW,N2SE,SESE;	A		NM
8619	CR	NM	23	0290N	0100E	17	NE,SENW,SW,N2SE,SESE;	A		NM
8630	CR	NM	6	0340S	0420W	14	E2,SW,S2NW;	A		KS
8635	CR	NM	23	0300N	0120W	19	SENE;	E		NM
8641	CR	NM	23	0200S	0250E	2	L4,SWNW,NWSW;	E		NM
8656	CR	NM	23	0150N	0060E	711	PT OF LOTS 1-5,S2NW,SE;	1		NM
8771	CR	NM	TX	141			BLK 79 T 1;SEC 5-8,17-20	1		TX
8772	CR	NM	TX	141			29,30 BLK 80 T 1,SEC 1,12	1		TX
25646600	ST	NM	23	0040N	0340E	15	XXXX	A	160	NM
25646603	ST	NM	23	0040N	0360E	27	XXXX	A	160	NM
25646604	ST	NM	23	0030N	0340E	20	XXXX			
25646611	ST	NM	23	0040N	0360E	17	XXXXX			
25646612	ST	NM	23	0040S	0310E	19	X X			
25646613	ST	NM	23	0040S	0310E	19	X			
25646614	ST	NM	23	0040S	0310E	19	X			
25646615	ST	NM	23	0030N	0350E	14	XX			
25646619	ST	NM	23	0050S	0310E	7	X X			
25646620	ST	NM	23	0050S	0310E	7	X			
25646621	ST	NM	23	0050S	0310E	7	X			
25821482	ST	NM	23	0030N	0260E	20	OF LND F			
26403128	ST	NM	23	0020S	0030W	31	MS378,MS			
26403532	ST	NM	23	0080S	0050E	28	OKLAHOM			
26572778	ST	NM	23	0100S	0190W	28	UNSURVE			
26572948	ST	NM	23	0190S	0150W	11	AND SWN			
26642397	ST	NM	23	0190S	0150W	23	1357, AND			
50463309	ST	CO	6	0050N	0670W	2	X			

For example, there are currently 4.8 million rows of data in the Land Description Table and 25.8 million rows in the Case Land Table



2.4 Project Initiation

On January 7, 1998, Michael Dombeck, Chief, Forest Service and Pat Shea, Director, Bureau of Land Management signed a Memorandum entitled "Bureau of Land Management-Forest Service Partnership for Land Management and Customer Services." This became known as the "Service First" initiative. Subsequently, a Partnership Agreement for an ALP/ALMRS Joint Development Project was signed on June 11, 1998 by four sponsors: Jack Arthur (Director, IRM) and Jack Craven (Director, Lands) for the Forest Service, and Gayle Gordon (Assistant Director, IRM) and Pete Culp (Assistant Director, Minerals, Realty & Resource Protection) for the Bureau of Land Management. Additionally, a Project Charter was signed in March, 1999 by the four project sponsors. With approval of this charter, the project was renamed the National Integrated Land System.

2.5 NILS Scope

BLM is in the process of developing a bureau-wide architecture to provide the framework for all information technology investments. This framework includes conducting business process analysis for BLM's core business functions. The NILS Project is conducting the business process analysis for the core business functions for providing land and resource title information. How these functions fit in the larger scheme of BLM's other business processes is depicted in Figure 2.3. Other land management agencies and organizations have similar business processes, and the NILS business processes (Figure 2.4) fit into these in a similar fashion.

Specifically, the NILS project is an initiative to develop a common solution for BLM and the Forest Service and their partners for the business processes involved with the management of cadastral land records. Because these business processes have much in common with those of the larger survey and land management community and the BLM and Forest Service are committed to working in partnerships, the NILS project is a cooperative venture. NILS will implement the Federal Geographic Committee's Cadastral (FGDC) Data Content Standard, while contributing to the National Spatial Data Infrastructure (NSDI). NILS is being managed using the Managed Evolutionary Development (MED) methodology, which is a phased development process. An overview of this process is included in Section 6.0.

Figure 2.3. The Context of the NILS Business Processes

The NILS business processes fit into a larger context of land and resource management business processes

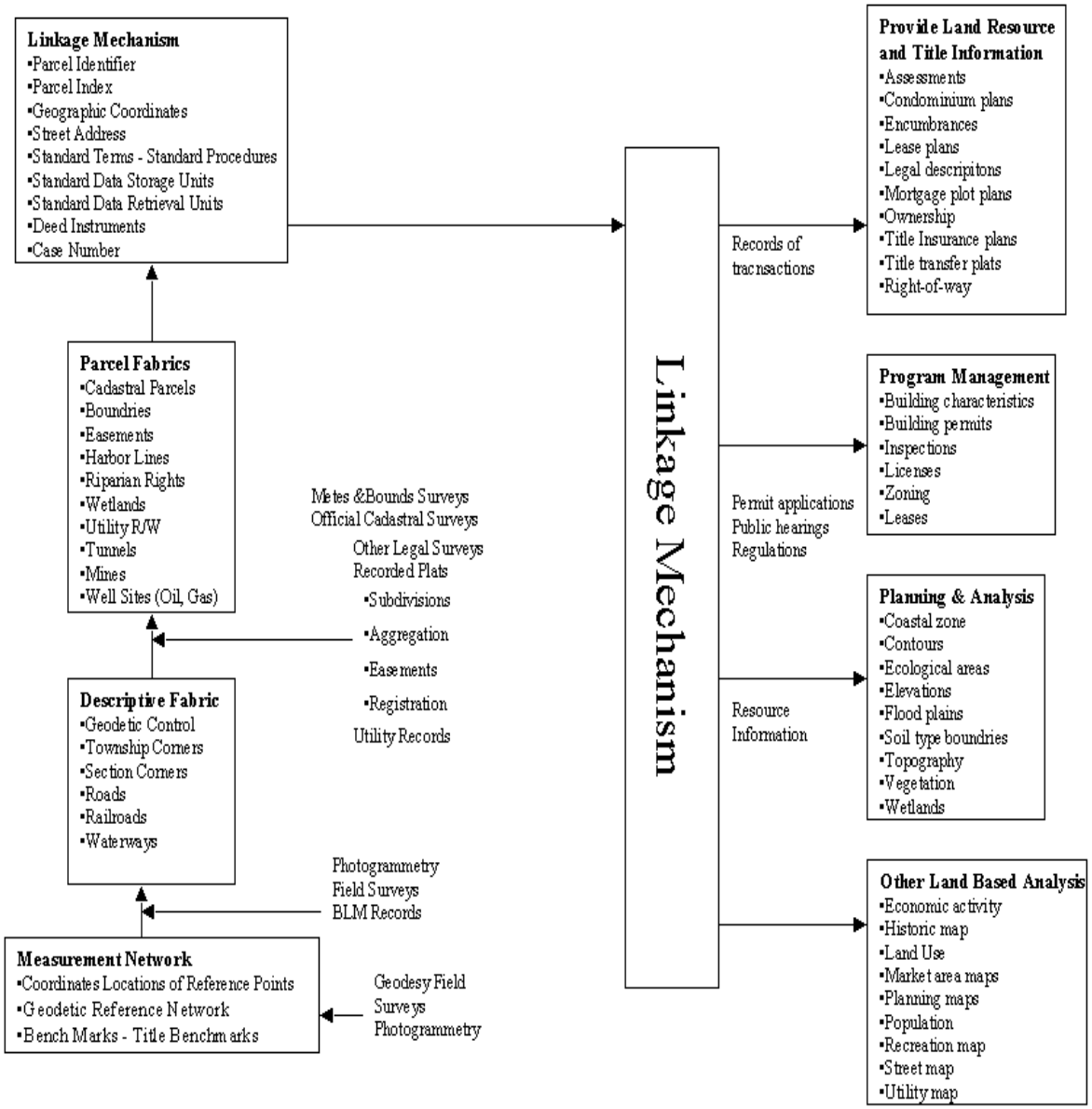
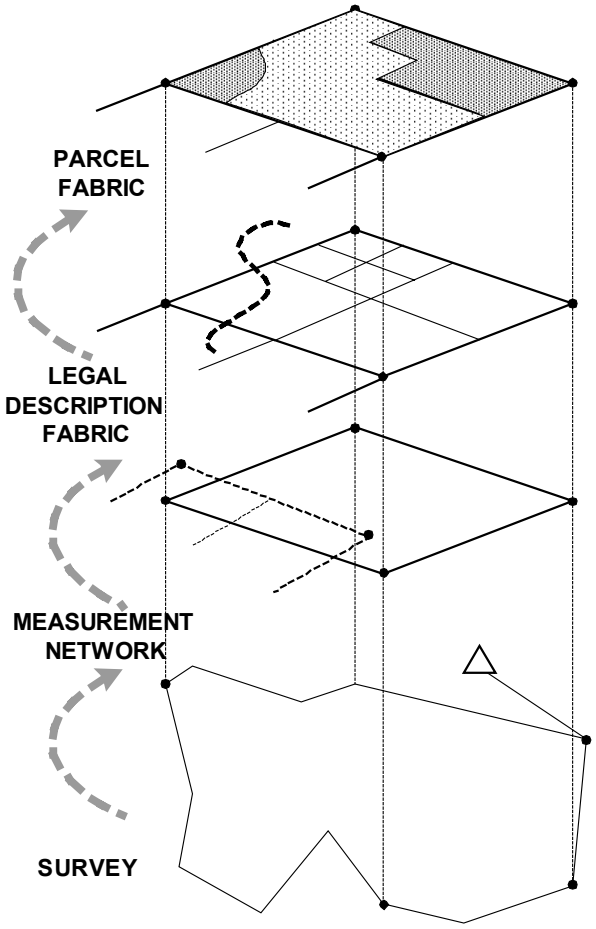


Figure 2.4. NILS Business Process Analysis



Manage Communications

- GC-04 Manage Event Notification Process
- GC-05 Manage Provider Account
- GC-07 Manage Subscriber Account
- GC-08 Manage Data Process
- GC-09 Manage Accounts
- GC-11 Manage Forums

GeoCommunicate

- GC-01 Conduct Search
- GC-02 Browse Search Results
- GC-03 Submit Event
- GC-06 Submit Data
- GC-10 Post Comment

GEOCOM

Construct Parcels from Legal Description Components

- PM-05 Edit Parcel Fabric
- PM-06 Edit Parcel Annotation

Manage Legal Description Fabric (resolve gaps and overlaps)

- PM-03 Edit Legal Description Fabric
- PM-04 Re-Adjust Fabric

Add, Create, Construct Legal Descriptions

- PM-02 Construct Legal Description

Identify and Verify Legal Descriptions

- PM-01 Verify Parcel

PARCEL MANAGEMENT

Analyze Survey Data and Construct Measurements

- MM-01Construct Measured Feature
- MM-02 Adjust Analyze Measurement Network
- MM-03 Edit Measurement Data

MEASUREMENT MANAGEMENT

Capture Survey Readings and Observations

- SM-02 Pre-Field Survey Setup
- SM-03 In-Field Survey Setup
- SM-04 Collect Field Data Observations
- SM-05 Perform COGO and Layout

Research

- SM-01SurveyResearch

SURVEY MANAGEMENT

SYSTEM

General Requirements

- Manage Data Transformation
- Make Formatted Output
- Compare/Contrast Data
- Reconstruct Historical Version of Data
- Administer Data Access Rights
- Audit Workflow Process

2.6 The Field-to-Fabric Concept

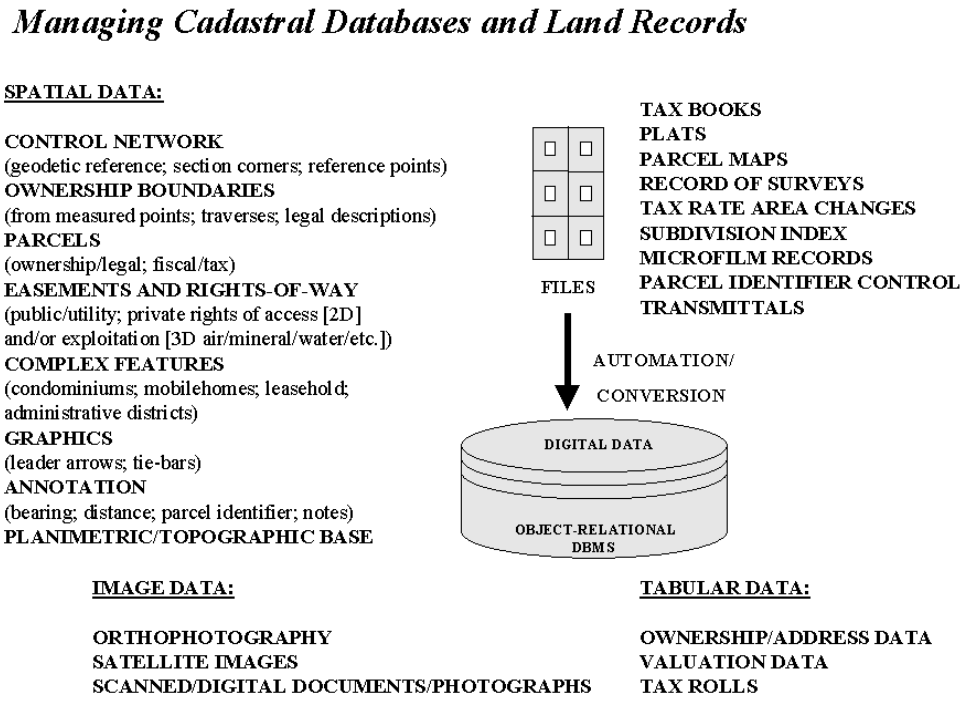
A central goal of NILS is that users would have the tools to manage land records and cadastral data in a Field-to-Fabric manner. This concept implies the fundamental goal of developing a common data model that unifies the worlds of Surveying and GIS. This unification concept is fundamental for land records managers and maintainers of cadastral mapping databases as they strive to improve the accuracy and quality of their data.

One prevailing pattern in the management of land records and cadastral data is that the accuracy of maps can be enhanced using new data acquired by more accurate techniques. As new surveys translate into legal descriptions and subdivision plats, map maintainers can use these new measurements as a source of control for their maps. The professional community of land surveyors and land records managers require better tools to find and extract data from a GIS, to use that data to prepare for and to complete a field survey, and to incorporate the new survey data as improved control to enhance the GIS.

The geographic representation of cadastral data is often managed as a series of maps (e.g., assessor map books, master title plats). Using GIS tools, these maps may be automated (digitally converted) and managed in a digital drawing environment. (See Figure 2.5) One of the desired characteristics of such maps is that all the map sheets may be combined into a single, seamless geographic representation, often called a map layer. When map layers are used to manage the geometry/geography of cadastral features like parcels, the individual features in the map layer should share geometry without gap or overlap. A **fabric** refers to a map layer of features that share geometry at nodes (corners) and edges (boundaries) in a seamless topological structure. When features in a fabric are edited, a change to a geometric element (i.e., a point, line or area feature) affects the shape of all features that are topologically tied to the edited feature.

There are many possible types of fabrics. A fundamental data model for NILS would include a common **fabric object** (super-class) that can be extended to handle various tiers of infrastructure depicting the cadastral (land) data. These tiers would include specific fabrics that contain control features, measurement features, surveyed coordinates, land boundaries, terrain features, land descriptions and constructed land units (parcels) as necessary to manage and display land use, land rights and land ownership. Common tools, properties, rules, and behaviors are needed to manage land from the fieldwork to the building and managing of the parcel fabrics.

Figure 2.5. Managing Cadastral Land Data



The NILS Project includes the business processes which involve the ability to provide land and resource title information (Figure 2.6).

The following is a brief description of the components of the NILS Project.

- **Common Cadastral (land) Data Model—**Data model built upon the FGDC Cadastral Content Standard, enhanced to meet the core functional requirements of the NILS partnerships. The model would contain feature object classes representing the properties, rules, and behaviors of cadastral entities, and designed as an open and extensible format to facilitate both generalization and customization.
- **Field Survey Process—**An integrated set of automation objects that are embedded into compatible survey data collection software packages to support the capture of measurement features and metadata into a database format. The goal of the Field Survey Process is to minimize the need for data conversion and re-construction as measured features are incorporated into the land records management system.
- **Measurement Management Process—**Produce a new feature coordinate solution by performing a weighted planimetric-geodetic adjustment according to the qualitative characteristics of individual feature elements in the working set. Measurement Management Process enables users to create a higher-quality, control network database for the Public Land Survey System (PLSS) and the non-Rectangular Survey System

(metes and bounds), relying upon much of the feature and functionality inherent in the GCDB Measurement Management system (GMM).

- **Parcel Management Process—**A process for managing land records and cadastral feature data stored in the database model, providing custom feature classes, tools, and procedures for editing land records in a transactional, history tracking environment. Users would be able to customize the Parcel Maintenance process to accommodate their established workflow and business processes.
- **GeoCommunicator—**A proactive Internet subscription process for sharing access to data stores and to planned and existing program project activities in cadastral and realty to facilitate collaborative capabilities and data sharing.

Figure 2.6. Process Flow